REQUEST
FOR STATEMENT of QUALIFICATIONS

from

HYDROGEOLOGIC AND HYDROLOGIC PROFESSIONALS

for

PROFESSIONAL SERVICES

Red Gap Ranch Water Resources Environmental Assessment

PROJECT NO.: 524900

RSOQ NUMBER: 2013-20

December 2012

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I. PUBLIC NOTICE

City of Flagstaff – Utilities Division
NOTICE of REQUEST for STATEMENT of QUALIFICATIONS (RSOQ) #2013-20
Red Gap Ranch Water Resources Environmental Assessment Services

The Utilities Division for and on behalf of, City of Flagstaff, is seeking Statements of Qualifications (SOQ's) from Hydrogeologic and Hydrologic professionals to provide an Environmental Assessment of the Red Gap Ranch Water Resources for the City of Flagstaff. The Red Gap Ranch Water Resources Environmental Assessment is financed in part with a grant from the U.S. Department of the Interior, Bureau of Reclamation, grant number R12AP32025.

SCHEDULE OF STATEMENT DEADLINES

Advertise for Services:	December 23 & December 30, 2012
Pre-Statement Meeting:	10:00 a.m. Monday, January 14, 2013 Council Conference Room 211 W. Aspen Avenue Flagstaff, AZ 86001
Statements Due:	3:00 p.m. Tuesday, January 22, 2013
Consultant Interviews (if necessary)	To Be Determined
Anticipated Award of Professional Services Contract:	To Be Determined

Sealed Statements may be **mailed** to: City of Flagstaff Purchasing Department, Attn: Patrick Brown, Senior Procurement Specialist, 211 West Aspen Avenue, Flagstaff AZ. 86001, or may be **hand delivered** to: City of Flagstaff Purchasing Department, Attn: Patrick Brown, Senior Procurement Specialist, 211 West Aspen Avenue, Flagstaff AZ., with the understanding that materials must be in hand by 3:00 p.m. Tuesday, January 22, 2013. All Statements must be labeled with RSOQ Number and Title. Sealed packets must also identify the name of the company or individual submitting the Statements. **Statements received after that time and date will be considered non-responsive and will be returned unopened.**

Complete information packets are available for download from: http://flagstaff.az.gov/bids.aspx. Request for Statement of Qualifications packages may also be obtained at the office of City of Flagstaff Purchasing Department, 211 W. Aspen Ave., Flagstaff, AZ 86001, or by calling Patrick Brown, Senior Procurement Manager, at 928-213-2277.

The City of Flagstaff reserves the right to reject any or all Statements, to waive or decline to waive irregularities in any Statement, or to withhold the award for any reason it may determine.

Published: December 23 & December 30, 2012

II. INSTRUCTIONS TO RESPONDENTS

GENERAL
All Statements should follow the format and sequence described in the paragraphs below; this will allow a standard basis for evaluation by a designated Evaluation Committee. Failure to follow the instructions regarding format may result in rejection of the Statement.

For the purposes of this request for SOQ's, the City of Flagstaff is hereinafter referred to as 'the City'.

CONTENT OF STATEMENT
Responses shall be submitted in sealed envelopes indicating which contract(s) submittal is in response to. The Statement of Qualifications shall not contain any reference to costs; data concerning labor hours, travel, consulting, materials and so forth. This cost information shall only be requested from firms that are awarded Contracts by Council.

The Statement should display clearly and accurately the experience, knowledge, and capability of the respondent to meet the requirements of this SOQ. **Six (6) copies and one (1) original of the Statement are required.**

The Statement should be fully self-contained, with all addenda, and should follow the format outlined in Part III of this SOQ. Presentations within the Statement should reflect consideration for the specific evaluation criteria included at the conclusion of Part III of this SOQ.

PRE-STATEMENT MEETING
A pre-statement conference will be scheduled for **Monday, January 14, 2013 at 10:00 AM** at City Hall – in the Council Conference Room located at 211 W. Aspen Avenue in Flagstaff. The purpose of the conference is to afford interested firms the opportunity of inquiring as to the specifics of this contract. Appropriate representatives from the City of Flagstaff will be present. Attendance is not mandatory; however no minutes will be published.

DELIVERY OF STATEMENTS
Sealed Statements may be **mailed** to: City of Flagstaff Purchasing Department, Attn: Patrick Brown, Senior Procurement Specialist, 211 West Aspen Avenue, Flagstaff AZ. 86001, or may be **hand delivered** to: City of Flagstaff Purchasing Department, Attn: Patrick Brown, Senior Procurement Specialist, 211 West Aspen Avenue, Flagstaff AZ., with the understanding that materials must be in hand by **3:00 p.m. Tuesday, January 22, 2013.** All Statements must be labeled with RSOQ Number and Title. **Statements received after that time and date will be considered non-responsive and will be returned unopened.**

No electronically transmitted Statements or electronically transmitted modifications of Statements will be considered. Statements received after the designated submittal deadline will be considered non-responsive and will be returned unopened.

INTERVIEWS
Respondents may or may not be requested to participate in one interview with the Evaluation Committee. A maximum of three firms may be selected for interviews.

Interviews, if conducted, will be for a maximum of 60 minutes as follows:

15 minutes:	Respondent may make a presentation to supplement the Statement information for the Evaluation Committee.
45 minutes:	Evaluation Committee question and answer time.

EVALUATION CRITERIA and BASIS FOR AWARD
The Evaluation Committee as established by the City will determine a recommendation for award. The qualifying criteria included in Part III will be used as the basis of this recommendation. The City will then negotiate with the selected firm for fee compensation that is determined to be fair and reasonable based on

final agreed upon scope. Award of contract(s) will be contingent upon mutually agreeable fee/scope of services negotiations.

FORM AND EXECUTION OF CONTRACT

The firm to which the City awards a contract shall, within ten (10) days after receipt of Notice of Award, sign and deliver signed copies of the contract as well as certificates evidencing the required insurance coverage to the City. All policies of insurance shall be reviewed and approved by the City before the successful respondent may proceed with the services.

DELIVERY OF MATERIALS

The firm to which the City awards a contract shall, within 10 days after receipt of Notice of Award, sign and deliver signed copies of the contract as well as certificates evidencing the required insurance coverages. Minimum insurance coverages shall be as specified in Attachment B. All policies of insurance shall be reviewed and approved by the City before the successful respondent may proceed with the services.

INTERPRETATION OF REQUESTS FOR SOQ BEFORE STATEMENT SUBMISSION

Respondents who desire further clarification of the Project Scope, conditions or requirements may attend the Pre-Statement Meeting, scheduled as shown in the Public Notice, with the City's designated Project Manager. Requests for individual meetings prior to the statement due date will not be granted. Specific questions may be submitted in writing to City of Flagstaff Purchasing Department, Attn: Patrick Brown, Senior Procurement Specialist, 211 West Aspen Avenue, Flagstaff AZ. 86001 or emailed pbrown@flagstaffaz.gov at least 3 business days prior to the Pre-Statement meeting. All submitted questions will be addressed at the Pre-Statement Meeting and should include the name and contact information of the agency/firm submitting the question(s).

EXAMINATION OF EXISTING CONDITIONS

Each respondent is fully responsible for, or accepts the consequences of waiving the responsibility for, visiting the City and becoming familiar with existing conditions and limitations under which the contracted services are to be performed, prior to submitting a Statement.

NON-DISCLOSURE OF DATA, REGULATIONS and OBLIGATIONS

Statements in response to this SOQ may contain data that the respondent does not wish to have disclosed for any purpose other than evaluation of the Statement. If so, the respondent must clearly identify those pages of the Statement that are to be restricted. The City assumes no liability for disclosure or use of unmarked data. Unless identified, information submitted in response to this Request for SOQ may be disclosed pursuant to the Arizona Public Records Law.

Should this SOQ result in a contract, the terms, clauses, and conditions required by City of Flagstaff procurement regulations shall apply to the contract.

This Request for SOQ does not obligate the City to pay any costs incurred in the preparation and/or submission of any Statements or any subsequent presentations or interviews, nor to enter into a contract with any of the Respondents.

III. ADDITIONAL INFORMATION

INSTRUCTIONS

The City of Flagstaff shall not be held responsible for any oral instructions. Any changes to this Request for Qualifications will be in the form of an addendum to the Statement of Qualifications. The addendum will be transmitted to all registered Request for Qualifications document-holders.

CITY RIGHTS

The City of Flagstaff reserves the right to reject any or all Statements of Qualifications, to waive any informality or irregularity in any Statement of Qualifications received, and to be the sole judge of the merits of the respective Statements of Qualifications received.

RELEASE OF PROJECT INFORMATION

The City of Flagstaff shall provide the release of all public information concerning the project, including selection announcements and contract awards. Those desiring to release information to the public must receive prior written approval from the City of Flagstaff.

CONTACT WITH CITY EMPLOYEES AND CONSULTANTS

All persons and/or firms that are interested in this project (including the firm's employees, representatives, agents, lobbyists, attorneys, and sub-consultants) will refrain, under penalty of disqualification, from direct or indirect contact for the purpose of influencing the selection or creating bias in the selection process with any person who may play a part in the selection process. This includes but is not limited to the evaluation panel, the City Manager, Assistant City Manager(s), Deputy City Manager(s), Department Directors or other staff. This policy is intended to create a level playing field for all potential firms, assure that contract decisions are made in public, and to protect the integrity of the selection process. All contact on this selection process should be addressed to the authorized representative identified in Section II.

CONTACT WITH ELECTED OFFICIALS (MAYOR, CITY COUNCIL)

Any contact pertaining to this selection process with elected officials must be scheduled, in person, through the Flagstaff City Clerk's Office, 211 W. Aspen Avenue, Flagstaff AZ 86001, and are posted by the City Clerk at least twenty-four (24) hours prior to the scheduled meeting. The Clerk's posting shall include and detail the participants and the subject matter, and shall invite the public to participate. No contacts made by telephone, other than to schedule a public meeting, are permitted. Copies of contacts made by letter, facsimile, e-mail, or other written method shall be made available to the public, press, and all submitting firms.

RESERVATION OF RIGHTS

There shall be no express or implied intent to contract until expressly stated in writing by Owner, an award is made, and all conditions stated herein are satisfied. The Owner reserves the right to reject any or all SOQs, or to withhold the award for any reason it may elect, and to waive or decline to waive irregularities in anyproposal.

IV. STATEMENT OF QUALIFICATIONS ORGANIZATION AND FORMAT

The Evaluation Committee will evaluate firms submitting responses to this request for SOQ's based on the information provided in the Statements of Qualifications (SOQ) and interviews as necessary. To allow for a standard basis of evaluation, all SOQ's are requested to follow a similar format. SOQ's shall not exceed **ten (10) pages total** in length excluding title, front and back cover pages, and addenda. Total allowable pages shall be double-sided 8 ½" x 11" with the exception of one page of an 11" x 17" fold-out. SOQ's should be organized with tabbed sections/dividers (excluded from page count) as follows:

Cover:

The cover should contain the following relevant data as a minimum:

- Statement indicating response to: **Red Gap Ranch Water Resources Environmental Assessment**
- **RSOQ #2013-20**
- Project No. 524900
- Submittal date
- Company name (and logo if desired)
- Other information/graphics as desired

Title Page:

Include Firm's name, address, e-mail/website address(es), phone and FAX numbers and name(s) of principals.

Executive Summary:

Address issues of experience, number of office personnel by discipline, ability and commitment to respond completely to the project scope, ability to keep design on schedule and within budget and local availability

of resources.

A. <u>Experience and Qualifications of the Firm/Team</u> (30 points)

1. Provide a general description of the firm/team that is proposing to provide the Red Gap Ranch Water Resources Environmental Assessment Services. Provide an organizational chart that shows key personnel.

2. Explain why your firm/team is the most qualified to perform your services in the vicinity of Red Gap Ranch. Describe the three (3) most recent projects that were performed in Northern Arizona or an area that demonstrates similar geological and climatological characteristics that demonstrate this qualification.

3. Demonstrate prior NEPA-related water resources environmental assessment work within the State of Arizona for the past ten (10) years (can include the three in item 2 if applicable).

   For each project identified, provide the following information:

   a. Description of the work.
   b. Role of the firm. Specify how much of the work was self-preformed or sub-contracted.
   c. Dates of the services were provided.
   d. Project Owner and contact information.

4 List all contracts where the firm/team have provided a Water Resources Environmental Assessment service within the previous ten years either completed or ongoing.

5. Reference information consisting of at least three professional references with current contact information. Additional client reference information may be requested from the top ranked firms, but is not required as part of the initial RSOQ submittal.

B. <u>Experience of Key Personnel to be Assigned to the Project</u> (40 points)

1. For the key person identified, list their length of time with the firm and demonstrate three years of professional level experience in Arizona hydrology, geology and water resource management. Individual must be a licensed engineer or geologist in the State of Arizona and have a Bachelor's degree in geology, hydrology, water resource management, natural resource management, engineering, environmental sciences, or related field. For each experience referenced, provide the following:

   a. Description of the service.
   b. Role of the person.
   c. Dates of the services were provided.
   d. Project owner.

2. For the key person identified, provide working knowledge of modern principles and practices of groundwater hydrology, hydrogeology or water resource engineering; knowledge of federal, state and local regulations and laws relating to the NEPA process and knowledge of current literature and research in the field of groundwater flow computer modeling.

3. For the Key person identified, demonstrate skills and abilities at making computations or estimates pertaining to reviewing water resource related projects; ability to write technically oriented reports and correspond clearly and concisely; have the ability to evaluate technical and statistical data in order to develop a valid scientific conclusion; have the ability to coordinate and communicate water resource matters with other departments, divisions, agencies, consultants; and ability to establish and maintain effective working relationships with other employees, agencies, contractors, and the general public.

4. For the key person identified, provide a copy of their license by the Arizona Technical Board of Registration as a Professional Geologist or Professional Engineer.

C. Understanding and Approach to Performing the Required Services (20 points)

1. Discuss the major issues your firm has identified and how you intend to address those issues.

2. Describe your firm's project management approach and organization during service delivery. Describe systems and scheduling used for implementing services described in the Scope of Services. Briefly describe the firm's experience in relationship building with clients.

3. Describe your firm's approach to participation on a larger team that includes City personnel, and others.

4. Describe how your firm's Project Manager (Responsible person in charge) will maintain accessibility to City Staff.

D. Technical Experience and Understanding (20 Points)

The City of Flagstaff has determined that it is important to the success of the Project that the team hired by the City be familiar with the groundwater and surface water interaction within the focused study area (see Attachment A for description of area), specifically with water and endangered species within Chevelon and Clear creeks.

1. Demonstrate the firm's knowledge and experience of local hydrology and hydrogeology with endangered species of Clear and Chevelon creeks, by specifying in the submittal their past experience, or understanding of, these interactions.

2. Demonstrate how data and results from this project may be used to support future NEPA work for this project.

E. Overall Evaluation of the Firm/Key Personnel and the Perceived Ability to Provide the Required Services (20 points)

This is to be determined by the selection panel members. No submittal response is required.

EVALUATION CRITERIA
Responses from respondents will be ranked based on points as detailed below

Section as described above:	Maximum Points Available:
A. Experience and Qualifications of the Firm/Team	**30**
B. Experience of Key Personnel to be Assigned to the Project	**40**
C. Understanding and Approach to Performing the Required Services	**20**
D. Technical Experience and Understanding	**20**
E. Overall Evaluation Of The Firm/Team	**20**

Total Maximum Achievable Points: 130

V. FEE PROPOSAL ORGANIZATION and FORMAT

FEE PROPOSAL FORMAT

A fee proposal will be requested of the respondent upon selection. RESPONDENTS should expect to be requested to provide any or all of the services enumerated in Section III of this RSOQ as Basic Services for a typical project. (Specify if Bid Phase and Post Bid Services are not included in your Basic Services fee.)

Attachment A

Scope of Services

Red Gap Ranch Water Resources Environmental Assessment City of Flagstaff, Arizona

I. Introduction

The purpose of this study is to provide the City of Flagstaff (City) and the U.S. Bureau of Reclamation (Reclamation) with a Water Resources Environmental Assessment for the City's proposed pumping of groundwater from the C aquifer from Red Gap Ranch (RGR) and any impacts the pumping may have on perennial reaches of Clear and Chevelon Creeks associated with species listed under the Endangered Species Act of 1973, as amended. This will be a groundwater modeling study that will meet the Council of Environmental Quality's National Environmental Policy Act (NEPA) Regulations, as described in Section 1508.9 for an Environmental Assessment. The City's contractor will utilize the existing Flagstaff Model to evaluate the potential area of impact due to groundwater withdrawal by simulating groundwater pumping from the C aquifer beneath Red Gap Ranch. The City's new "Flagstaff Model" is a finite difference three-dimensional groundwater flow model of the primary aquifers of the region, including the R and C aquifers of the Colorado Plateau, in MODFLOW computer code (AMEC, 2012). The work stated within will be a collaborative effort between the City, Navajo Nation, U.S. Fish and Wildlife Service (FWS), and Reclamation through the Coconino Plateau Technical Advisory Committee (CPTAC). In addition, this study will utilize the groundwater pumping limits that the City established with the Navajo Nation through a 2011 Stipulation between the two parties, as well as satisfy a provision of the Stipulation that states the City and Navajo Nation will work collaboratively on evaluating any environmental impacts to area water resources by the pumping of groundwater by either party.

II. Project Goal

This Scope of Services (SOS) describes the groundwater modeling tasks associated with conducting an Environmental Assessment for proposed RGR groundwater pumping and the possible effects on water resources within the Little Colorado River Sub-basin of the Coconino Plateau. Of particular importance is the possible impact to perennial reaches along Chevelon and Clear Creek, located near Winslow, Arizona, that are associated with Federally-listed species. The City's groundwater flow model, the Flagstaff Model, will be the base model for the study. The Flagstaff Model is a MODFLOW model constructed by the USGS in 2011, known as the Northern Arizona Regional Groundwater Flow Model (NARGFM; Pool, et al., 2011) and refined and recalibrated in 2012 within a focused study area that includes the City of Flagstaff and Red Gap Ranch, both within the Little Colorado River groundwater sub-basin (AMEC, 2012). The proposed pipeline alignments to the City cross Federal lands, and the project is partially funded by Federal dollars, both a driver for the NEPA process. Information obtained from this Environmental Assessment will be used by Reclamation during preparation of an Environmental Impact Statement (EIS) for the North Central Arizona Feasibility Study.

This study should address the following questions: 1) how far the effects of the proposed groundwater withdrawal for the proposed scenarios extend, 2) how those affects are reflected on surface flows (springs/rivers/intermittent drainages, 3) how those affects are reflected in groundwater levels throughout

the area of impact, and 4) how will data from this Water Resources Environmental Assessment be used for Section 7 of the Endangered Species Act.

III. Background and Objectives

In 1998, the Arizona Department of Water Resources (ADWR) organized a regional study to evaluate future municipal water demands for communities in northern Arizona. In 2000, the United States Congress allocated funding to Reclamation to conduct an appraisal level regional water study as authorized by the Reclamation Act titled the North Central Arizona Water Supply Study for the ADWR regional study area on the Coconino Plateau. In 2006, Reclamation published their Report of Findings that by 2050 there will be an annual unmet water demand of 28,100 acre-feet in the study area (Reclamation, 2006). In 2009, Federal funds were made available through Reclamation's Rural Water Program to take the study to the feasibility level. Two water supply alternatives are being assessed under this Program, the Western Navajo Pipeline and the Red Gap Ranch (RGR) Pipeline. The City is conducting the RGR Water Resources Environmental Assessment related to proposed groundwater pumping by the City from RGR, as work applicable to an EIS that will be completed by Reclamation.

The RGR property consists of 25,000 acres comprised of approximately 8,500 acres of deeded land and approximately 16,500 acres of leased Arizona State Trust Lands that are presently used for livestock grazing. RGR is located about 40 miles east of Flagstaff at an elevation that is approximately 2,000 feet lower than the City. The study area (also referred to as the focused study area) is illustrated on Figure 1 and is bounded by the Mogollon Rim (or the groundwater divide between the Verde and Little Colorado River sub-basins where appropriate) to the south, the Diamond Rim Fault to the southwest in the Verde Valley, the Mesa Butte Fault to the west and north and the Little Colorado River to the east. As discussed further in this SOS, the eastern extent of the focused study area may need to be extended further east to properly model withdrawals of other significant pumpers of the C aquifer (i.e., Cholla Power Plant).

When the City acquired RGR, there were 18 groundwater wells on the property. In 2011, the City drilled ten new pilot wells into the C aquifer to obtain hydrogeologic information. The City plans to pump and deliver water from these wells at RGR to Flagstaff in 2021.

IV. Previous Work

There have been significant investigations conducted in the vicinity of RGR that focus on the geology, hydrology, data collection and modeling of the groundwater system. A useful list of publications compiled from a variety of organizations is provided in Appendix A. The selected consultant will be expected to utilize all pertinent available data when making revisions to the Flagstaff Model and evaluating any impact of groundwater pumping from RGR.

The City of Flagstaff has a database of water levels at Red Gap Ranch to aid with calibration. The U.S. Geological Survey (Brown and Macy, 2012) has been collecting baseflow data in the area of Clear Creek, Chevelon Creek and the Little Colorado River that will also be useful for calibration to water levels to this area of environmental concern.

V. Surface Water

Surface water at RGR is scarce and only exists when rain or snowmelt fill dry creeks or washes that traverse RGR. Off the site, however, are surface water features that may support wildlife or important habitat, such as that at Raymond Wildlife Area, located about 40 miles southeast of Flagstaff and managed by the Arizona Game and Fish Department. While these are not thought to be linked with groundwater it will be up to the contractor, along with the City, to work with Government agencies to determine what features need to be represented in the model and how they are to be simulated.

Of greater importance to this study is the proper representation of springs and baseflow that feed perennial reaches of Clear Creek, Chevelon Creek and the Little Colorado River area that are located east and south of the ranch, near Winslow. The USGS has an on-going effort to conduct spring surveys and baseflow data within this area (Brown and Macy, 2012) that will be useful for calibration and stream profiles. While

these features are in the Flagstaff Model and simulated using the MODFLOW River Package, development may be required to convert back to the MODFLOW Stream Package, or to the Drain Package, while further discretization and elevation checking may be required to better simulate the area.

VI. Groundwater Modeling Analysis

The City of Flagstaff and Navajo Nation proposes to pump groundwater from RGR and area north of RGR from the C aquifer. The groundwater flow modeling efforts conducted under this SOS will be based on the existing regionally calibrated groundwater flow model known as the Flagstaff Model. The basis of the Flagstaff Model is the USGS NARGFM as previously mentioned. Improvements and refinements to the NARGFM were made by AMEC Environment & Infrastructure, Inc. for the City of Flagstaff, in 2012 (AMEC, 2012). The grid of the NARGFM was refined for an area termed the "focused study area," that includes RGR (Figure 1). This area represents the hydrologic extent within the Flagstaff Model where the hydrologic influence of model inputs and outputs were closely tracked, within an area of well understood hydrological boundary conditions. Grid spacing was refined from 1,000 by 1,000 meters to 250 by 250 meters in the vicinity of Flagstaff; however, the spacing east of Flagstaff, including Red Gap Ranch, is 1,000 meters by 250 meters. As part of the update to the Flagstaff Model, the model was also re-calibrated for a transient calibration period from 1910 through 2010. Use of this model will reduce the amount of effort required to characterize the general groundwater conditions in the area around RGR. The extents of the model layers can be found in the USGS NARGFM Report (Pool and others, 2011).

For a complete list of modifications made to the NARGFM to develop the Flagstaff Model, refer to the attached excerpts from the Flagstaff Model report (AMEC, 2012).

Evaluate Existing Model

The consultant will evaluate the existing Flagstaff Model and identify refinement opportunities and/or expansion of the focused study area by reviewing the regional geology and subsurface hydrology as it pertains to the C aquifer within the focused study area (Figure 1). Attached to this SOS are the first three Chapters from the Flagstaff Model report (AMEC, 2012) which includes a list of modifications made to the NARGFM to develop the Flagstaff Model (Chapter 1), a description of the regional geology and hydrogeology (Chapter 2), and model development (Chapter 3). The Chapter on model development includes information on the model domain, grid discretization, model layer descriptions, input parameters, wells, boundary conditions, time steps, calibration, among other necessary information that may be important to this SOS.

The following information should be used at a minimum when evaluating the Flagstaff Model and its applicability to the study area.

A. Water Levels

The selected consultant will need to evaluate available depths to water and water level elevations above mean seal level for both the C and R aquifers within the focused study area and identify historical trends in water level changes with time. This also includes streamflow and spring elevations in the vicinity of the Clear Creek, Chevelon Creek and the Little Colorado River area. Data collected by theCity and the USGS will be provided by the City, for wells in the area and for springs and baseflow in the area of Clear Creek, Chevelon Creek and the Little Colorado River.

B. Aquifer Thickness

The selected consultant will need to identify changes required, if any, of the Flagstaff Model based on information collected from the drilling of 10 water wells in 2011 by the City of Flagstaff at RGR, two wells at the Twin Arrows Casino by the Navajo Nation in 2011 and 2012, and any other recently drilled wells. Additionally, primary structural geologic features should be evaluated such that they are represented relative to the proposed refinements to the model and may introduce City-conducted structural geology analyses on RGR to illustrate their impact to the groundwater system.

C. Aquifer Hydraulic Properties

The City and others (Twin Arrows Casino) have completed tests on the wells at RGR and other area wells that postdate the development of the NARGFM and updating of the Flagstaff Model. The selected consultant should evaluate the results of these tests in order to determine if the estimates of aquifer parameters including transmissivity, hydraulic conductivity and storage within the C aquifer need to be changed within the Flagstaff Model.

D. Groundwater Budget

An attempt should be made to refine the existing evaluation of the components of inflow and outflow to the regional groundwater system in order to evaluate these components in the Flagstaff Model within the focused study area.

a. Aquifer recharge (inflow)

In the NARGFM, natural recharge was estimated using the Basin Characterization Model (BCM) by Flint and Flint (2008) and isotopic analyses developed by Blasch and Bryson (2007) as discussed in their report (Pool and others, 2011). Incidental recharge from agricultural irrigation, golf courses, septic systems as well as artificial recharge (municipal and community wastewater treatment facilities) were also incorporated into the NARGFM. Recharge added to the Flagstaff Model includes that as discharge within the Rio de Flag from Flagstaff's wastewater treatment plants, and seepage through Upper Lake Mary and Lake Elaine.

Primary recharge to the RGR area is from Anderson Mesa where annual recharge was simulated in the NARGFM and the Flagstaff Model from 0 to 1 inches per year. The primary recharge to Clear and Chevelon creeks and the Winslow area is from the Mogollon Rim. Simulated recharge at the rim is from 5 to 7 inches per year. RGR and Winslow receive approximately 8 inches of precipitation on an annual average basis. This precipitation comes as either winter snowfall or summer rainfall and may also be a significant component of inflow to the groundwater system. The consultant should evaluate whether updating the annual volumes of water C aquifer is necessary and is properly represented in the Flagstaff Model for use under this SOS, as well as assure correlation of infiltration rates with surface geology (or other method) is properly represented.

b. Aquifer discharge (outflow)

Groundwater pumping in the region is proposed by the City and by the Navajo Nation (future Leupp pumping center). Existing pumping in the region includes that by the Town of Winslow, industrial pumping for the Cholla Power Plant at Joseph City, Tribal pumping (Cameron, Leupp, Twin Arrows), and other municipal and private entities. In addition to groundwater pumping, the USGS has documented outflow to include spring discharge and downward migration from the C aquifer to the R aquifer throughout the study area.

Flagstaff Model Refinement and Calibration

Refinements may include, but are not limited to:

- Refinement of the model grid size to a uniform grid spacing in the vicinity of Red Gap Ranch and Clear and Chevelon Creeks, from the 1,000 by 250 meter grid in the Flagstaff Model.
- Extension of the focused study area further to the east to capture regional groundwater pumpers.
- Parameterization of hydraulic conductivity values, using data from previously conducted aquifer tests (i.e., incorporate spatial discretization).
- Modify layer geometries, if necessary, based on the results of the shallow well installations, upon analyzing a City-conducted study on the structural geology of RGR, and other project information available (such as Twin Arrows) for the focused study area.
- Incorporate local surface waters (i.e., Raymond Ranch or any others) as discrete features in the model.

- Calibrate the model to 2012 groundwater elevations within the focused study area, including but not limited to those collected by the City from RGR wells, collected for wells in the Leupp area and by the Town of Winslow, at Twin Arrows, and to information collected by the USGS as part of a cooperative data project, specific to groundwater levels and baseflow of the Little Colorado River, Chevelon and Clear Creeks (Brown and Macy, 2012).
- Refine how perennial stream reaches were simulated in the Flagstaff Model using the River Package in MODFLOW (e.g. Clear and Chevelon Creeks, Little Colorado River) rather than the MODFLOW Stream Package that was used in the NARGFM. This switch of packages was made in the Flagstaff Model given the scale of the model and the time required to sequentially renumber the entire length of perennial stream reaches.

Where appropriate, the automated inverse optimization program PEST should be used to expedite the calibration process.

Analysis

1. Software

The Flagstaff Model runs on standard versions of MODFLOW-2000 and MODFLOW-2005, which are available from the USGS. Additionally, the selected consultant will utilize the pre-processor Groundwater Vistas v.6. (Scientific Software Group, 2008).

2. Data Management

The selected consultant shall manage all geologic and hydrologic data related to the model development using ESRI's ArcGIS platform in a spatial and geodatabase format that is compatible with the City's GIS System.

3. Model Domain

The model domain is the USGS Northern Arizona Groundwater Flow Model (NARGFM) (Pool and others, 2011), refined and recalibrated within the focused study area, which is referred to as the Flagstaff Model. The option for telescopic mesh refinement (TMR) and creating a nested model within, or changing the focused study area boundary, is possible to better simulate the area of interest.

4. Model Grid

Grid spacing was refined in the Flagstaff Model from 1,000 by 1,000 meters to 250 by 250 meters in the vicinity of Flagstaff; however, the spacing east of Flagstaff, including Red Gap Ranch, is 1,000 meters by 250 meters. The selected consultant shall recommend an appropriate model grid discretization including cell dimensions and time-steps based upon the evaluation of the spatial distribution of available data and the ability to achieve the desired objectives of this study. The coordinate system for the modeling effort will be compatible with the City's Geographic Information System NAD83 State Plane/U.S. feet.

5. Model Boundaries

The boundary of the NARGFM is quite extensive and is bounded by the Mogollon Rim south of Eagar, Whiteriver, Pinetop Lakeside and Payson and includes Prescott and terminates east of Kingman, extends north to include much of the Colorado River through Grand Canyon National Park, north to include Page, and then southeast to include Gallup as illustrated on Figure 1. The focused study area of the Flagstaff Model is bounded by the Mogollon Rim (or the groundwater divide between the Verde and Little Colorado River sub-basins where appropriate) to the south, the Diamond Rim Fault to the southwest in the Verde Valley, the Mesa Butte Fault to the west and north and the Little Colorado River to the east.

The existing numerical model boundary conditions for this project may be extended to include important hydrologic and/or topographic conditions of the study area. The consultant should evaluate the applicability of TMR imbedded within the Flagstaff Model (perhaps using the focused study area as the boundary for

TMR). The focused study area of the Flagstaff Model will likely expand to the east, as the boundary is currently too close to Chevelon Creek for proper simulation of impacts to the area of Clear Creek, Chevelon Creek and the Little Colorado River, and also to capture pumping centered near Winslow and to the east near Holbrook. Simplifying assumptions may need to be made to appropriately represent hydrologic conditions.

Flow through the C aquifer within the focused study area of the Flagstaff Model is fracture flow modeled with Darcy's Law (the Equivalent Porous Media [EPM] concept) and large faults/fracture systems are modeled as polygons of uniform hydraulic conductivity within the concept of EPM. When evaluating the Flagstaff Model and its applicability to this project, concern on whether this concept applies to this region should be considered, especially if grid refinement is suggested. The true shape of faults/fracture systems may need to be refined from the NARGFM.

6. Model Layers

The Flagstaff Model has three layers: Layer 1 represents the confined portion of the C aquifer where the aquifer bearing units of the Coconino Sandstone and middle to upper Supai Group are overlain by confining beds within the Chinle or Moenkopi Formations. The extent of Layer 1 in the area of RGR may need refinement following the evaluation of water levels and available new hydrogeologic information. Layer 2 represents the unconfined C aquifer within the Coconino Sandstone and the middle to upper part of the Supai Group, which occurs below Red Gap Ranch and west to include Flagstaff. Layer 3 represents the R aquifer, which is comprised of the Redwall and Muav Limestones, and is separated from the C aquifer by confining units of the Lower Supai Formation.

Should future pumping water demand be required, the data will be provided from the CPTAC USGS Scenarios Model and modified as appropriate, which will be provided by the City and Navajo Nation.

7. Model Input Parameters

Parameters in the Flagstaff Model should be reevaluated for hydraulic conductivity, specific storage, porosity and possible stage, bottom elevation and sediment bottom thicknesses of stream flow reaches using new data if available. All of these input parameters for each model layer should be reevaluated based upon discussion in Section VI, Evaluate Existing Model.

8. Calibration

Calibration should be to 2012 conditions. The selected consultant should define evaluation criteria to quantitatively determine whether the numerical model is adequately calibrated. Examples of criteria that should be used are Root Mean Error, Mean Absolute Error and Mean Error of actual measured versus simulated water levels.

9. Capture Zone Analysis – Particle tracking

The selected consultant should evaluate conducting capture zone analyses of the City's and Navajo Nation's water production wells and/or well fields using the USGS MODPATH particle tracking model (Pollock, 1994). The purpose of conducting reverse particle tracking is to delineate water supply capture zones to better define spatially the volume of groundwater and the location of recharge that is available for withdrawal by the City's and Navajo Nation's water supply wells.

10. Sensitivity Analysis

The selected consultant should conduct an adequate sensitivity analysis on the assumptions made for model input parameters and grid discretization to assess the model's reliability and uncertainty. The purpose of the sensitivity analysis will be to quantify this uncertainty in terms of the model's calibration compared to the deviation in water level and water balance predictions.

11. ASTM Groundwater Modeling Guidelines

Modeling efforts conducted for this project must follow applicable American Society for Testing and Materials (ASTM) groundwater modeling guidelines (ASTM, 1999) that may include:

- Standard Guide for Application of a Groundwater Flow Model to a Site-Specific Problem (ASTM D5447-93);
- Standard Guide for Comparing Groundwater Flow Model Simulations to Site-Specific Information (ASTM D5490-93);
- Standard Guide for Defining Boundary Conditions in Groundwater Flow Modeling (ASTM D5609-94);
- Standard Guide for Defining Initial Conditions in Groundwater Flow Modeling (ASTM D 5610-94);
- Standard Guide for Conducting Sensitivity Analysis for a Groundwater Flow Model Application (ASTM D 5611-94);
- Standard Guide for Documenting a Groundwater Flow Model Application (ASTM D5718-95); and,
- Standard Guide for Calibrating a Groundwater Flow Model Application (ASTM D5891-96).

12. Predictive Scenarios

In order to predict possible impacts to area water resources with proposed groundwater pumping at RGR and to the north by the Navajo Nation, the selected consultant will need to work with the City's Utilities Division staff and the CPTAC, to refine the several future predictive groundwater scenarios presented below. It is expected that up to five (5) predictive scenarios may be conducted as part of this study, however, only three are proposed at this time.

The potential impacts that may be assessed by the groundwater flow model for the RGR and Navajo pumping scenarios below may include:

- Potential changes in groundwater levels and flow directions that may affect surrounding wells, streams and wetlands (if present);
- Changes to baseflow of any creeks, rivers, or springs (including Blue Springs) within the area of influence;
- Particle tracking or capture zone analysis to determine flow paths and travel time;
- Impact considering IPCC climate change scenario;
- Other impacts that may be defined through the scoping process.

Baseline Scenario

This scenario is intended to reflect holding constant all existing pumping for groundwater users within the focused study area for 100 years. Simulations of flow paths and travel times from the property to surrounding areas will be performed in order to compare the magnitude of the effects of the analyzed alternatives. Current pumping by communities and industries will be included in this "baseline" simulation.

Proposed RGR Groundwater Pumping Scenario

This scenario will evaluate the potential area and magnitude of impact due to groundwater withdrawal at RGR by simulating groundwater pumping from the C aquifer beneath RGR as described above. Areas of focus include base flow to perennial steams such as Clear and Chevelon Creeks and the Little Colorado River. The Contractor will also evaluate if there is any connection of the C aquifer with any surface water or groundwater features of all habitat/areas that may be impacted by groundwater withdrawal, such as the Raymond Wildlife Area, owned by the Arizona Game and Fish Department that is located about 40 miles southeast of Flagstaff.

Cumulative Impacts of Proposed RGR and Navajo Pumping Scenario

Cumulative impacts with pumping by the Navajo Nation to the north of RGR and by the City from RGR must be considered in the environmental review process. This scenario will evaluate the potential area of impact due to groundwater withdrawal by both parties. Areas of concern include base flow to perennial steams such as Clear and Chevelon Creeks and the Little Colorado River. The Contractor will also evaluate if there is any connection of the C aquifer with any surface water or groundwater features in the area of Federal or State owned wildlife properties, such as the Raymond Wildlife Area, owned by the Arizona Game and Fish Department that is located about 40 miles southeast of Flagstaff.

Other Scenarios

The City wishes to include two (2) additional scenarios within this SOS for scoping purposes by the selected consultant, should the need arise to include additional alternatives.

VII. Meetings

a. The contractor should plan for five meetings with the City and other stakeholders:
   - "kickoff" meeting,
   - prior to running scenarios,
   - results of running scenarios,
   - presentation of the model and final results to City Staff, and
   - presentation of the model and final results to the CPTAC.

VIII. Deliverables

a. 5 – paper copies of DRAFT report
b. 5 – paper copies of FINAL report
   i. Electronic files of FINAL report (PDF, WORD, AutoCAD, ArcGIS, etc)
   ii. Electronic MODFLOW input & output files, Groundwater VISTAS files
   iii. Any other electronic files (Excel, GIS, etc.) used to create model input and present model results

IX. Conflicts of Interest

In the Response to the Scope of Services, applicants must identify all consulting matters and projects that may pose a potential or actual conflict of interest to the City of Flagstaff, and describe the nature of the conflict with sufficient detail to enable the City to evaluate whether the conflict may be waived. The City shall have the sole and absolute discretion to determine whether a potential or actual conflict may be waived, and the City may reject a Response solely on the basis of a conflict, without further comment or explanation to the applicant. **Applicants are encouraged to consult with the City Attorney regarding any potential or actual conflicts of interest in advance of submission of a Response to the Scope of Services**.

APPENDIX A

U.S. Geological Survey Publications

Appel, C.L. and D.J. Bills, 1979, Map Showing Groundwater Conditions in the Canyon Diablo Area, Coconino and Navajo Counties, Arizona: U.S. Geological Survey, Water resources Investigations Open-File Report WRI-OFR 80-747

ADWR Water Atlas for LCR Subbasin, online at (last accessed December, 2012): http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/EasternPlateau/PlanningAreaOverview/WaterSupply.htm

Bills, D.J., Truini, M., Flynn, M.E., Pierce, H.A., Catchings, R.D. and M.J., Rymer, 2000, Hydrogeology of the regional aquifer near Flagstaff, Arizona: U.S. Geological Survey WRI 00-4122, 143 p.

Bills, D.J., Flynn, M.E., and S.A. Monroe, 2007, Hydrogeology of the Coconino Plateau and adjacent areas, Coconino and Yavapai counties, Arizona: U.S. Geological Survey SIR 2005-5222

Brown, C. R., and Macy, J.P., 2012, Groundwater, surface-water, and water-chemistry data from C-aquifer monitoring program, northwestern Arizona, 2005-11: U.S. Geological Survey Open-File Report 2012-1196, 37 p.

Cooley, M.E., Harshbarger, J.W., Akers, J.P., and Hardt, W.F., 1969, Regional Hydrogeology of the Navajo and Hopi Indian Reservations, Arizona, new Mexico, and Utah: U.S. Geological Survey Professional Paper 521-A, 61 p.

HydroGeoChem, Inc., 1994, Effects of Non-Indian Groundwater Usage on Reservation Water Resources within the Little Colorado River Basin – Draft, August 12, 1994

Leake, S.A., Hoffman, J.P., and Dickinson, J.E., 2005, Numerical Groundwater Change model of the C aquifer and Effects of Groundwater Withdrawals on Stream Depletion in Selected Reaches of Clear Creek, Chevelon Creek, and the Little Colorado River, Northeastern Arizona: U.S. Geological Survey Scientific Investigations Report 2005-5277, 29 p.

Mann, L.M., 1976, Groundwater Resources and water use in Soutehrn Navajo County Arizona: U.S. Geological Survey, Arizona Water Commission Bulletin 10, Phoenix, Arizona, 106 p.

McDonald, M.G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference groundwater flow model: U.S. Geological Survey WRI – Book 6, Chapter A1, 586p.

McGavock, E.H., 1968, Basic Groundwater data for southern Coconino County, Arizona: U.S. Geological Survey prepared for the Arizona State Land Department Water Resources Report 33, March 1968

McGavock, E.H., Anderson, T.W., Moosburner, O. and L.J. Mann, 1986, Water resources of southern Coconino County, Arizona: U.S. Geological Survey prepared for the Arizona Department of Water Resources Bulletin #4, Tucson, Arizona, 53 p.

Pollock, D.W., 1989, Documentation of computer programs to compute and display path lines using MODPATH – a particle tracking post-processing package for MODFLOW: U.S. Geological Survey OFR 89-381

Pool, D.R., Blash, K.W., Callegary, J.B., Leake, S.A., and Graser, L.F., 2011, Regional Groundwater-Flow Model of the Redwall-Muav, Coconino, and Alluvial Basin Aquifer Systems of Northern and Central Arizona. Scientific Investigations Report 2010-5180. U.S. Geological Survey Scientific Investigations Report 2010-5180, April 12, 2011

Pool, D.R., 2011, DRAFT – Simulation of Groundwater Withdrawal Scenarios for the Redwall-Muav and Coconino Aquifer Systems of Northern and Central Arizona, Prepared in cooperation with the Coconino Plateau Water Advisory Committee

Reilly, T., and Harbaugh, A.W., 2004, Guidelines for Evaluating Groundwater Flow Models: U.S. Geological Survey SIR 2004-5038

Publications for the City of Flagstaff

AMEC, 2012, Final Groundwater Modeling Impact Analysis, City of Flagstaff, Water Resource Sustainability Study, Coconino County, Arizona: AMEC, Phoenix, Arizona, prepared for the City of Flagstaff, 42 p.

HydroSystems, Inc., November 2009, Red Gap Ranch Data Analysis Report, Coconino County, Arizona: HydroSystems, Inc., Tempe, Arizona for the City of Flagstaff, 26 p.

HydroSystems, Inc., 2011, Red Gap Ranch Shallow Water Production Wells Completion Report, Coconino County, Arizona: HydroSystems, Inc., Tempe, Arizona for the City of Flagstaff, 130 p.

Water Demand Analysis, 2009: City of Flagstaff Utilities Department Integrated Master Plan - Water Resources Element – April 2009

Other Publications

Anderson, M.P., and Woessner, W.W., 1992, Applied Groundwater Modeling – Simulation of Flow and Advective Transport: Academic Press, Inc., 381p.

ASTM, 1999, Standards on Determining Subsurface Hydraulic Properties and Ground Water Modeling, 2nd Edition, 336 p.

HDR Engineering, Inc., 2003, Western Navajo-Hopi Water Supply Needs, Alternatives, and Impacts.

HydroSystems, Inc., July 2003, Red Gap Ranch Groundwater Resources Phases I and II Report: HydroSystems, Inc., Tempe, Arizona for Red Gap Ranch, LLC, 83 p.

HydroSystems, Inc., 2004, Numerical groundwater flow model of the Red Gap Ranch in the south-central portaion of the Colorado Plateau in northeastern Arizona: HydroSystems, Inc., Tempe, Arizona for Red Gap Ranch, LLC, 55 p.

Kelly, S.E., 2000, Groundwater flow simulation and recharge sources for a fractured sandstone aquifer, Coconino County, Arizona: Northern Arizona University – Master of Science in Geology Thesis

Reclamation, 2006, Reclamation Rural Water Supply Act of December 22, 2006 (Pub. L. 109-451, Title I, 120 Stat. 3346, 43 U.S.C. 2401, et seq.)

S.S. Papadopulos & Associates, Inc.,, 2005, Groundwater Flow model of the Coconino Aquifer in Arizona and New Mexico, Bethesda, Maryland, 35 p.

Scientific Software Group, 2012, Groundwater Vistas v.6: Scientific Software Group, Sandy, Utah 84070, www.scisoftware.com

United States Bureau of Reclamation, 2006, North Central Arizona Water Supply Study: U.S. Bureau of Reclamation, October 2006, 163p.

Western Technologies, 2004, Phase I Environmental Site Assessment, Red Gap Ranch, Two Guns, Arizona: Flagstaff, Arizona, Western Technologies Inc., report prepared for the City of Flagstaff, 257 pages.

Attachment B

Sample Service Agreement
(Separate Document)

Attachment C

Grant Provisions
(Separate Document)